Pearson BTEC Level 3 Nationals Certificate, Extended Certificate

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Learner Registration Number

Time 1 hour 30 minutes

Paper reference **21325L**

Applied Human Biology

UNIT 1: Principles of Applied Human Biology

You will need:
A calculator and a ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and learner registration number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need*.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question*.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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Pearson

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 One function of the kidney is to remove toxic substances from the blood.

Figure 1 shows the structure of a nephron in the kidney.

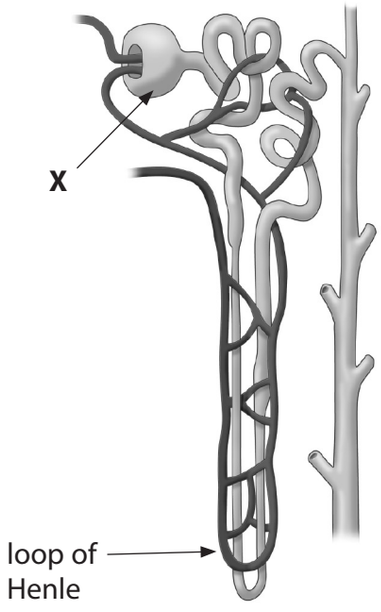

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Figure 1

(a) Name structure **X** in Figure 1.

(1)

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(b) A network of capillaries surrounds the nephron.

Explain how this adaptation allows substances to be absorbed back into the blood.

(2)

(c) Another function of the kidney is to maintain the water balance in the body.

(i) In the nephron, some water leaves the loop of Henle and re-enters the blood.

Which process allows water to leave the nephron?

(1)

☒	**A** active transport
☒	**B** exocytosis
☒	**C** osmosis
☒	**D** ultrafiltration

(ii) When the brain senses that the blood's water level is too low, there is an increase in the release of antidiuretic hormone (ADH).

State the effect on the urine concentration when ADH levels are increased.

(1)

(d) The blood leaving the kidney will have a different amount of water compared with the blood entering the kidney.

State **one other** difference between the blood entering and the blood leaving the kidney.

(1)

(Total for Question 1 = 6 marks)

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2 The immune system produces antibodies in response to specific antigens on the pathogens.

(a) Which type of cell produces antibodies?

(1)

☒	**A** B lymphocytes
☒	**B** mast cells
☒	**C** phagocytes
☒	**D** T killer cells

(b) When a person is exposed to a pathogen, the concentration of antibodies in the person's blood changes as time passes.

Figure 2 shows the changes in antibody concentration after two exposures to the same pathogen.

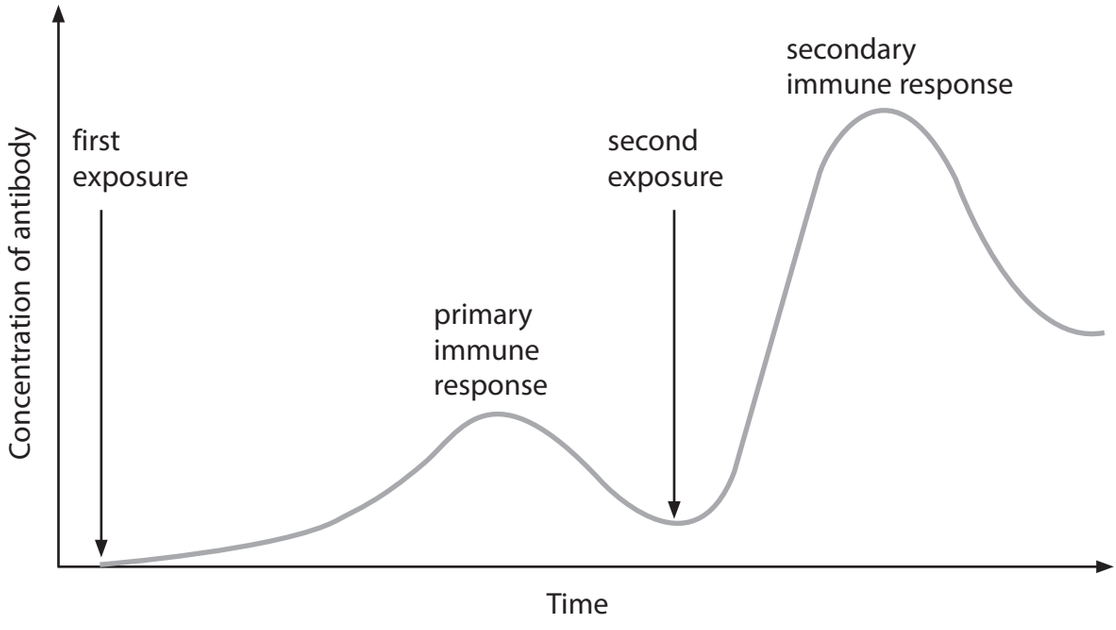

Figure 2

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Explain the difference between the speed of the primary immune response and the speed of the secondary immune response, shown in Figure 2.

(3)

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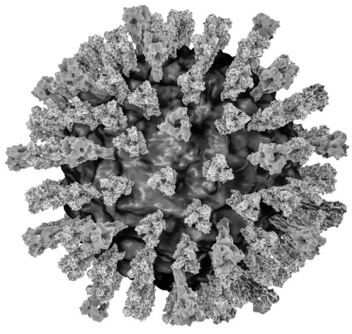
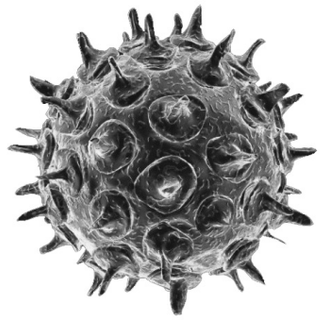
(c) Chicken pox and measles are both diseases caused by viruses.

Figure 3 shows the structure of these two viruses.



measles virus



chicken pox virus

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Figure 3

If a person is vaccinated against the measles virus, the person can still become ill with chicken pox.

Explain why.

(3)

(Total for Question 2 = 7 marks)

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3 (a) Neurones allow impulses to be transmitted within the body.

An impulse passes from one neurone to the next across a synapse.

Figure 4 shows the connection between two neurones, and the structure of the synapse.

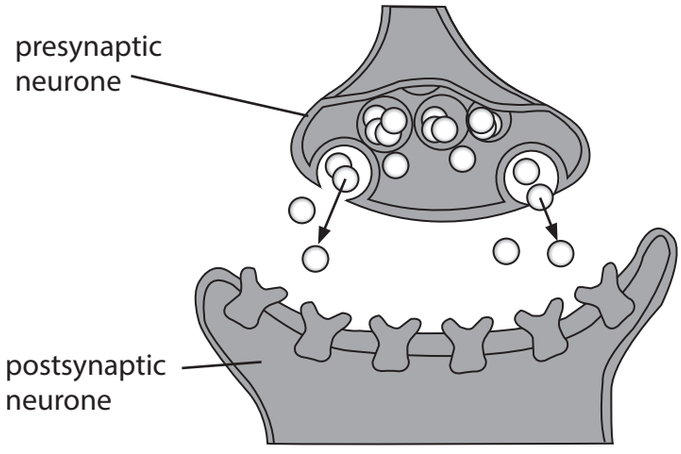

Figure 4

Explain how the presynaptic and postsynaptic neurones allow transmission of the impulse across the synapse.

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(b) A doctor tests the function of the nerves in a patient's leg.

Complete Paragraph 1 to show the outcome of the nerve function test.

(2)

The doctor taps the tendon in the patient's ..... with a hammer.

There is no movement of the patient's leg.

The absence of a ..... action indicates there is reduced nerve function.

Paragraph 1

(Total for Question 3 = 8 marks)

4 (a) A doctor uses an electrocardiogram (ECG) to test a patient's heart function.

Describe how ECG readings are produced.

(2)

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(b) Figure 5a and Figure 5b show the ECG readings for two different patients.

Patient A

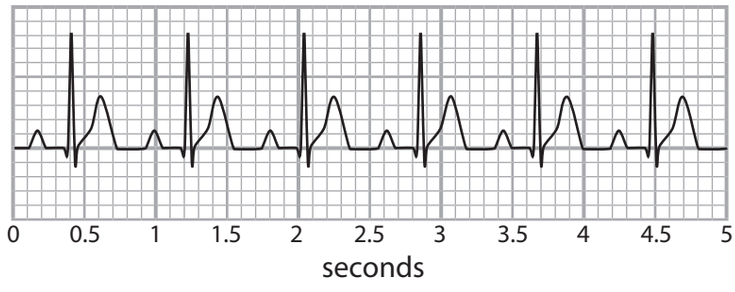

Figure 5a

Patient B

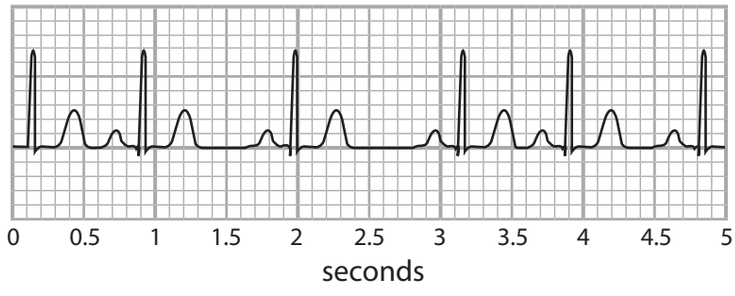

Figure 5b

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Patient A has normal heart function.

Patient B has abnormal heart function.

(i) Calculate, using Figure 5a, the heart rate of patient A in beats per minute (bpm).

(3)

heart rate = ... bpm

(ii) Explain how Figure 5b shows that patient B has abnormal heart function.

(2)

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(c) A patient with poor heart function may have their blood oxygen levels measured.

Explain **two** ways to measure blood oxygen levels.

(4)

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(Total for Question 4 = 11 marks)

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5 (a) A cell's plasma membrane controls the movement of substances into and out of the cell.

Figure 6 shows the structure of a plasma membrane.

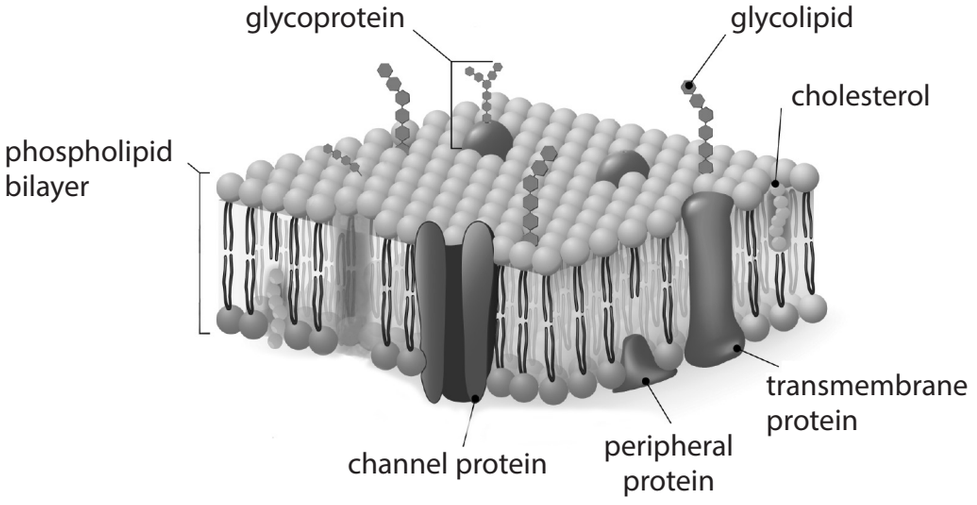

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Figure 6

(i) Identify the component of the plasma membrane that has a role in cell signalling.

(1)

☒	**A** channel protein
☒	**B** glycolipid
☒	**C** phospholipid
☒	**D** transmembrane protein

(ii) State the function of cholesterol within the plasma membrane.

(1)

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(b) Substances can move across the plasma membrane by simple diffusion or facilitated diffusion.

Explain **one** similarity and **one** difference between simple diffusion and facilitated diffusion.

(4)

Similarity

Difference

(c) (i) Active transport uses adenosine triphosphate (ATP) as an energy source.

Name the cell organelle that produces ATP.

(1)

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(ii) ATP contains a molecule of adenine, a ribose sugar and three phosphate groups.

Figure 7 shows a molecule of ATP.

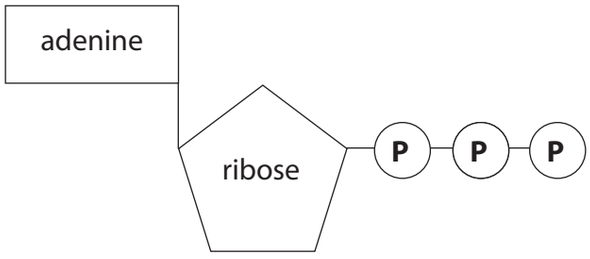

Figure 7

Describe how the cell uses ATP to provide energy.

(3)

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(Total for Question 5 = 10 marks)

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6 Eating a balanced diet provides the body with the minerals needed to maintain normal body function.

(a) Which mineral is needed for healthy bone growth?

(1)

☒	**A** calcium
☒	**B** chloride
☒	**C** sodium
☒	**D** sulfur

(b) Figure 8 shows a diagram of the digestive system.

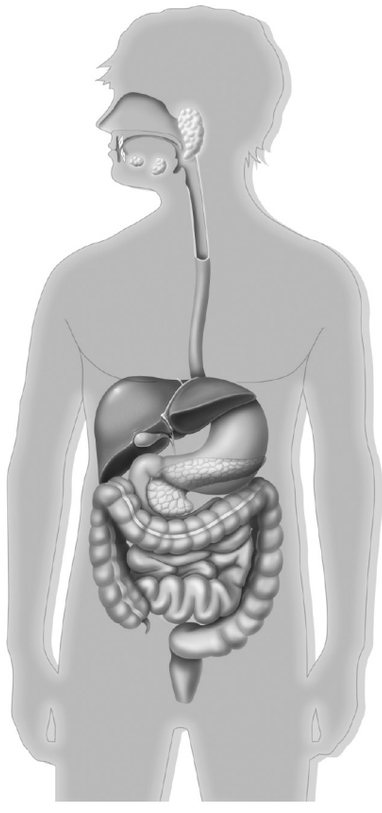

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Figure 8

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Discuss how chemical processes break food down as it passes through the digestive system.

Your answer should include

- the role of enzymes
- how optimum conditions help digestion.

(9)

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(Total for Question 6 = 10 marks)

7 Figure 9 shows a section of DNA in a gene that codes for the protein haemoglobin.

GTGCACCTGACTCCTGAG

Figure 9

(a) (i) Identify the mRNA sequence complementary to the section of DNA in Figure 9.

(1)

☒	**A** CACGTGGACTGAGGATCT
☒	**B** CACGUGGACUGAGGACUC
☒	**C** GTGCACCTGACTCCTGAG
☒	**D** GUGCACCUGACUCCUGAG

(ii) Give the number of codons shown in the section of DNA in Figure 9.

(1)

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(b) A mRNA molecule leaves the nucleus and travels into the cytoplasm.

Figure 10 shows a polypeptide chain produced by a mRNA, tRNA and ribosome complex in the cytoplasm.

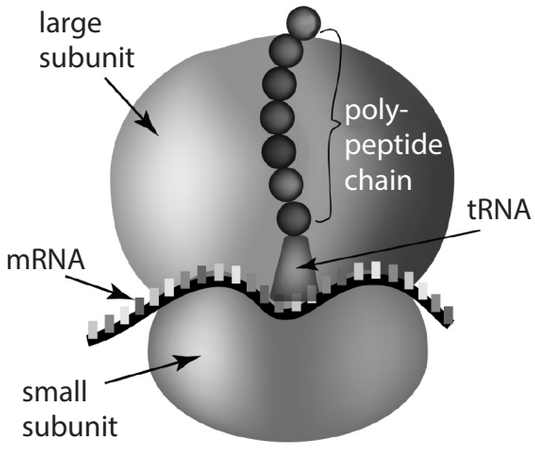

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Figure 10

(i) Identify the process that produces a polypeptide chain.

(1)

☒	**A** replication
☒	**B** splicing
☒	**C** transcription
☒	**D** translation

(ii) Describe the role of tRNA in producing a polypeptide chain.

(4)

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(c) When a mutation happens in a DNA sequence, the mutation may affect the expression of a gene.

One location within DNA where a mutation can happen is in a non-coding sequence.

This type of mutation can affect the binding of RNA polymerase and change the rate of expression of the gene.

(i) Explain **two other** locations within DNA where mutations can happen and how each affects expression of a gene.

(4)

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(ii) A mutation in a gene **may not** result in a change to the protein produced.

Explain why the same protein might still be produced after a mutation in the DNA.

(3)

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8 The cell mediated immune response involves several different types of T cells, including killer T cells.

(a) Describe how killer T cells recognise and destroy cells infected with pathogens.

(3)

(b) Genetic mutations affecting the T cells can cause various types of immunodeficiency.

If a doctor thinks a patient has an immunodeficiency, a test can be done to show this.

The doctor will take a blood sample from the patient.

Give **two** ways this blood sample can be analysed to test for an immunodeficiency.

(2)

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(c) Severe combined immunodeficiency (SCID) is a disorder where the immune system does not function normally.

People with SCID are more likely to have pathogen infections.

A person diagnosed with SCID has been offered **two** alternative treatments.

Both treatments are available on the NHS.

Table 1 shows a summary of each treatment.

stem cell therapy	immunoglobulin replacement therapy
patient is given a bone marrow transplant containing immune system stem cells	patient is given an injection of a serum containing antibodies
if successful, the cells will continue to divide and differentiate to form a functioning immune system	treatment must be given regularly as antibodies are broken down as time passes

Table 1

Evaluate these **two** treatment options for a patient with SCID.

(9)

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(Total for Question 8 = 14 marks)

TOTAL FOR PAPER = 80 MARKS

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